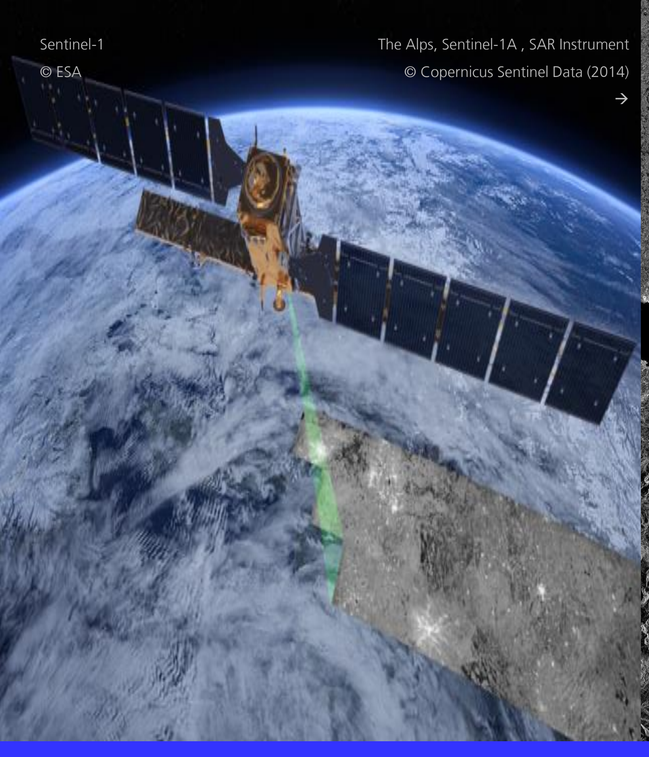

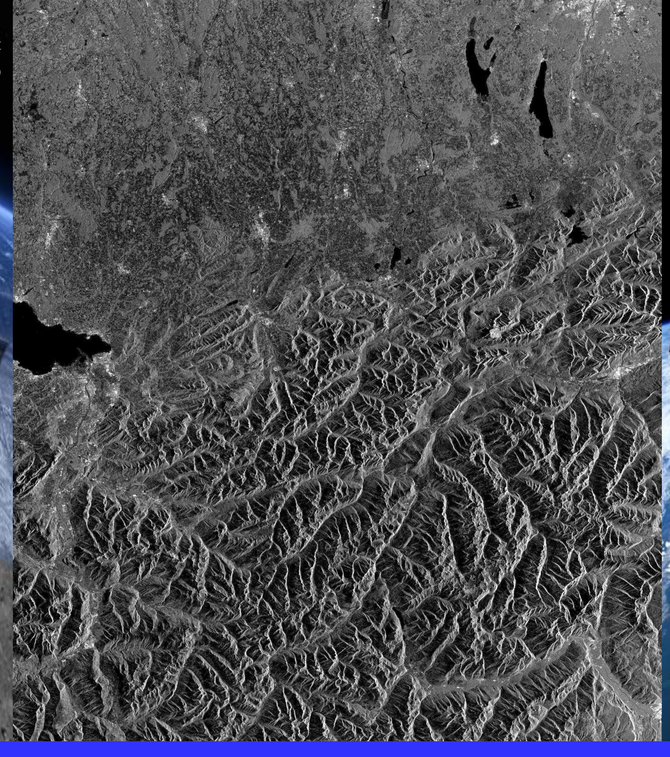

German Remote Sensing Data Center
International Ground Segment

Three years of operations of the Sentinel-1 and Sentinel-3-OLCI PAC at German Aerospace Center

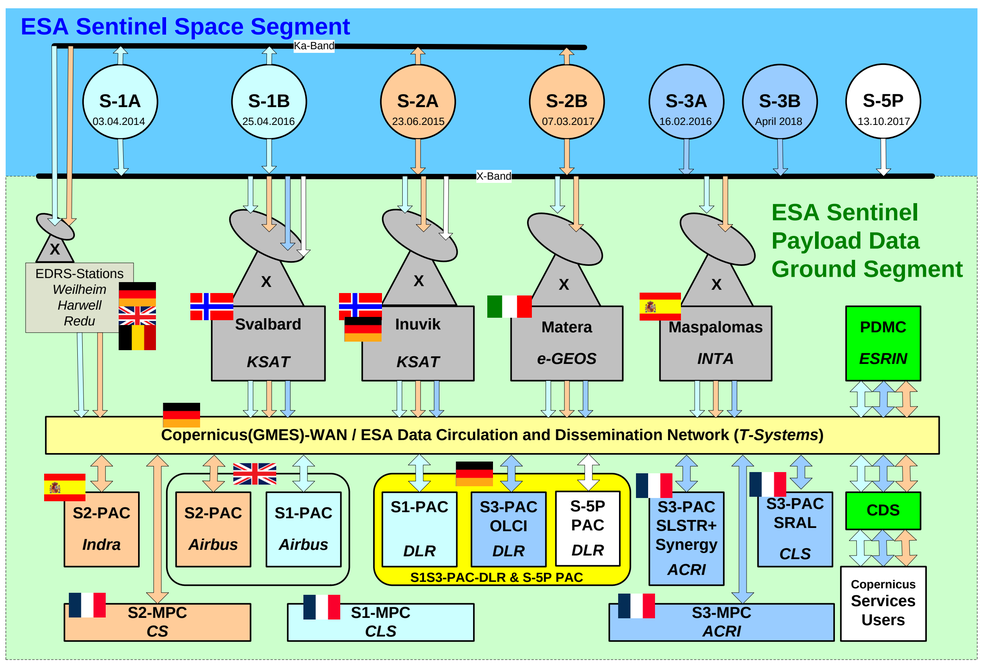

Fig. 1: Overall structure of the Copernicus Payload Data Ground Segment (PDGS): Ground Stations and PACs

Copernicus is the European Earth Observation Programme, conducted jointly by the EC, ESA, EUMETSAT and the EC member states. The Sentinel satellites constitute the Copernicus space segment. Since 2014 already six Sentinel satellites have been launched successfully. The core payload data ground segment (PDGS) for the Sentinel satellites is managed by ESA and operated by national partners. In this core PDGS, DLR has been selected to install and operate Processing and Archiving Centers (PACs) for Sentinel-1A/B and the data from the Ocean and Land Colour Instrument (OLCI) aboard Sentinel-3A/B.

Daily, around 940 products are being processed based on sensor data from the OLCI instrument on Sentinel-3A, over 330 GB of associated data are stored in the LTA of the DLR-PAC. The Sentinel-1A and Sentinel-1B satellites are already supplying many times that amount. Over 10 TB and more than 4700 products from the satellite pair are handled every day. In the first three years of operations the DLR-PAC has already processed and archived over 3.8 million data sets. They represent a data volume exceeding 6500 terabytes (6.3 petabytes).

High-Level Tasks of the Sentinel PAC

- reception of Sentinel data from the network of Core Ground Stations (CGS) via electronic link (Copernicus WAN);
- ingestion of these data into the Short-Term Archive (STA) and Mid-Term Archive (MTA) of the Sentinel PGDS;
- in addition ingestion of these data in a Long-Term Archive (LTA) for addressing future science challenges;
- perform consolidation and re-assembly of level-0 data received from CGS;
- perform systematic and request-driven processing of Sentinel data to higher-level products;
- host Sentinel data products within a layered architecture of on-line dissemination elements that facilitate the data access of end-users via public networks;
- share and exchange any locally processed data with a second partner PAC for the purpose of redundancy;
- capability to reprocess large amounts of data.

For Sentinel-1 the second PAC is located in Newport (UK). For Sentinel-3 there exists a work share between the DLR-PAC (responsible for data over land areas) and EUMETSAT (datasets over marine areas).

Long-Term Archive (LTA) service of DLR-PAC

DLR's German Satellite Data Archive was significantly enhanced in the year 2013. DLR has a robotic storage library available that is capable to manage about 10,000 storage slots. The storage tape technology which is utilized is the T10000C tape drive standard of Oracle through which it is possible to store up to 5 TB of data natively on one single cartridge. In its final configuration the DLR tape archive is able to host 50 PB (50 Million GB) of data.

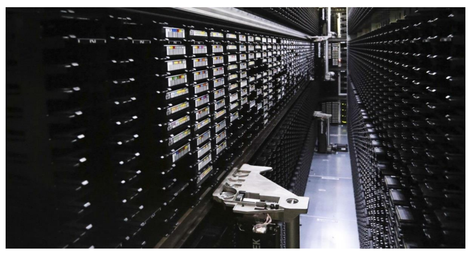

Fig. 2: DLR's StorageTek SL 8500 Robotic Tape Library

Data Ingestion into the LTA

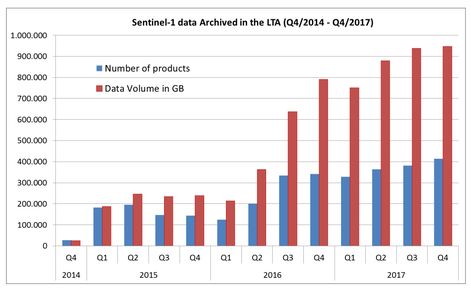

Fig. 3: Sentinel-1 data archived in the DLR-PAC LTA (per quarter, Q4/2014 – Q4/2017)

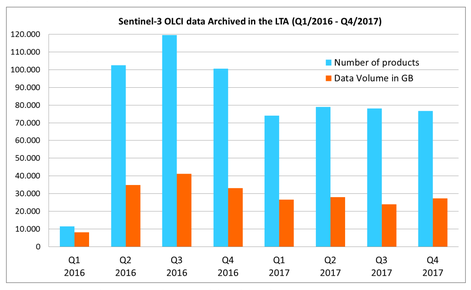

Fig. 4: Sentinel-3 OLCI data archived in the DLR-PAC LTA (per quarter, Q1/2016 – Q4/2017)

Satellite mission	Number of products	Data Volume in TB	Products / day	TB / day
Sentinel-1	3,181,731	6,301	2841	5.63
Sentinel-3 OLCI	642,009	222	940	0.33
Total data ingestion	**3,823,740**	**6,523**		

Tab. 1: Summary of Data archived into the LTA until end of 2017

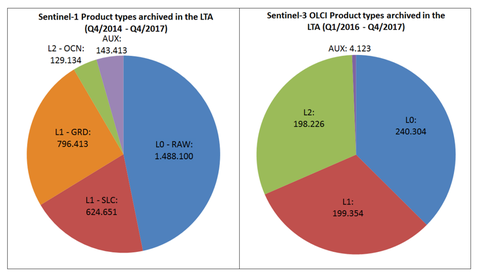

Fig. 5: Distribution of the archived Sentinel-1 and Sentinel-3 OLCI Data Product types until end of 2017

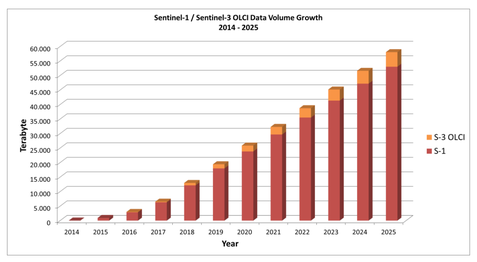

Fig. 6: Current and expected Sentinel-1 and Sentinel-3 OLCI Data Volume growth at DLR-PAC LTA in the timeframe 2014 – 2025

Data Retrieval from the LTA

Satellite mission	Number of products	Data Volume in TB
Sentinel-1	69,847	48.22
Sentinel-3 OLCI	2,665	0.87
Total data retrievals	**72,512**	**49.10**

Tab. 2: Summary of Data retrieved from the LTA until end of 2017

Data access support for the CMEMS project

On request of ESA DLR-PAC is providing a dedicated data access support for the Copernicus Service Project CMEMS (Copernicus Marine Environment Monitoring Service, http://marine.copernicus.eu). DLR-PAC has established a FTP server that provides access to Sentinel-1 data for CMEMS since September 2014. CMEMS is the successor project to the Copernicus Project MyOcean since May 2015.

CMEMS focuses on the provision of coastal and marine environment applications in the fields of marine safety, marine resources, and weather, climate and seasonal forecasting. A wide range of data is delivered by the service (e.g. temperature, salinity, sea level, currents, wind and sea ice). An important application is e.g. the derivation of sea ice drift observations and ice deformation information.
More than 420,000 products and more than 310 TB of data have been provided for the CMEMS project. On a monthly average CMEMS has access to about 12,000 Sentinel-1 products (data volume ~ 9 TB).

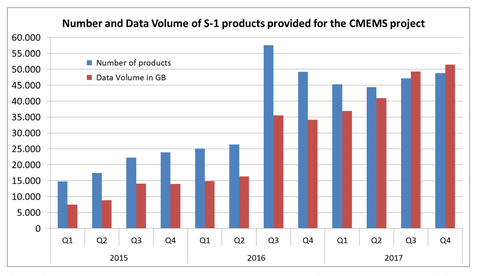

Fig. 7: Number of Sentinel-1 products and Data Volume in GB provided for the CMEMS project (per quarter, 2015-2017)

Deutsches Zentrum für Luft- und Raumfahrt

Dipl.-Ing. Thomas Hahmann
German Aerospace Center (DLR)
German Remote Sensing Data Center (DFD)

82234 Wessling, Germany
Tel.: +49 8153 281644
E-Mail: thomas.hahmann@dlr.de